

(12) UK Patent Application (19) GB (11) 2 265 224 A  
(43) Date of A publication 22.09.1993

(21) Application No 9206068.0

(22) Date of filing 20.03.1992

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(51) INT CL<sup>6</sup>  
G01R 31/28 // G01R 1/067

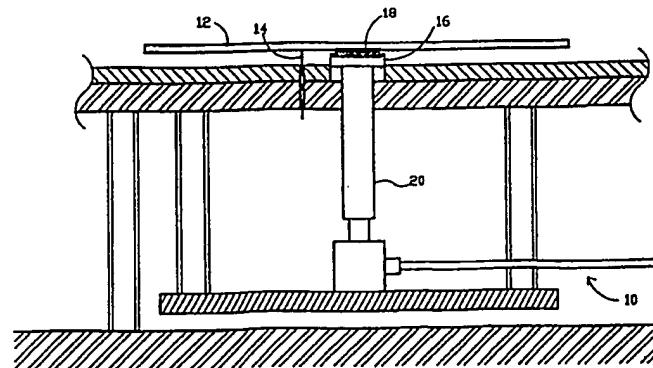
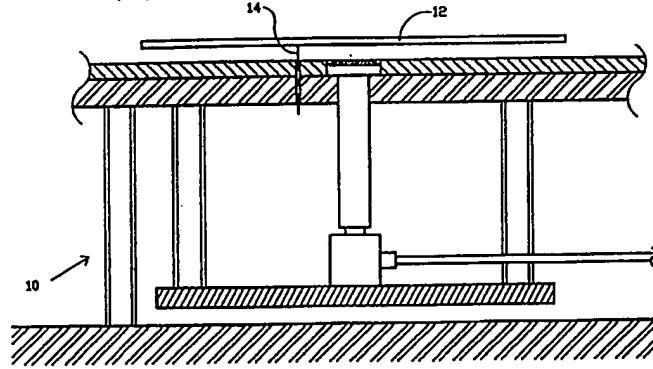
(52) UK CL (Edition L)  
G1U UR1067 UR3128  
H2E EAH  
U1S S2087

(56) Documents cited  
GB 2215064 A GB 2156532 A EP 0250620 A1  
WO 89/00296 A1 US 4571542 A US 4056773 A  
US 4012693 A

(58) Field of search  
UK CL (Edition L) G1U UR3128  
INT CL<sup>6</sup> G01R 31/28

(54) Testing printed circuit boards

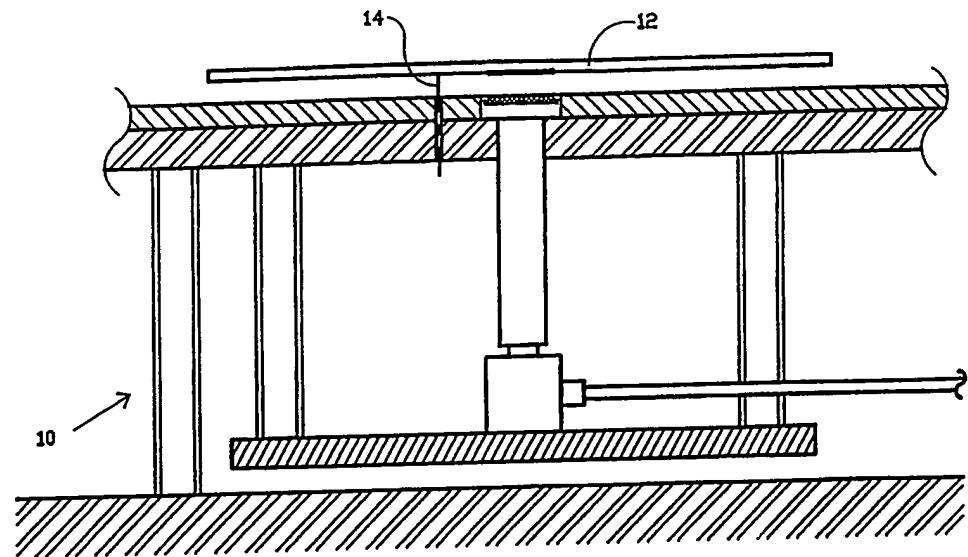
(57) A probe (14) may be used to contact a printed circuit board (12) in both an isolation test (Figure 1) and a continuity test (Figure 2), a strip of conductive rubber (18) being used to provide a conductive bridge between certain points on the board in the continuity test. The rubber (18) may be arranged in grooves in a metal platform (16) which can be raised or lowered (20) as required.



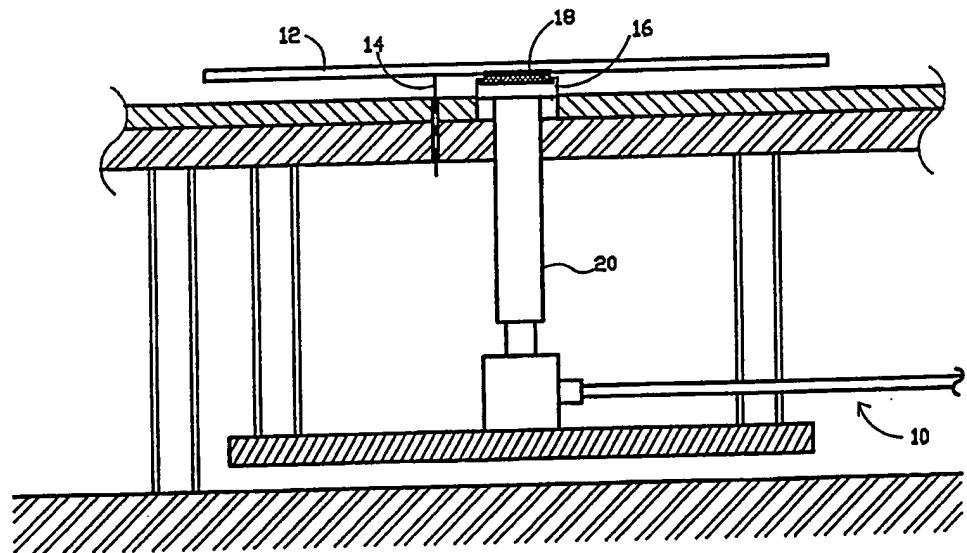
At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

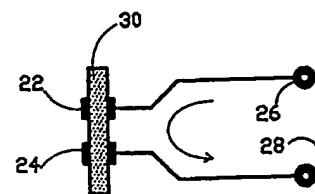
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-Fig. 1-



-Fig. 2-



-Fig. 3-

TESTING APPARATUS

This invention relates to a testing system for circuit board units such as printed circuit boards (PCB).

5 It is an object of this invention to provide a higher testing speed for PCB's over some traditional testing systems.

Testing apparatus in accordance with the invention comprises means to effect an isolation test on a 10 circuit board, said isolation test means being also used to effect a continuity test on the same circuit board in combination with other means.

Suitably the isolation test means is a probe(s) to contact a certain point on the circuit board, thereby 15 checking for any shorts in the circuit board.

Advantageously the means which in addition with the isolation test means effects the continuity test, is a member supporting at least one strip of conductive rubber in order to bridge two points on the circuit board, thereby 20 checking for any line breaks in the circuit board.

Preferably the support member is moved towards and away from the circuit board by cylinder means.

The present invention reduces the time consumed in the testing process as compared to the prior art. 25 Moreover, the cost on fixture and maintenance are also reduced.

Each testing apparatus suitably uses a miniature

pneumatic cylinder which is actuated through a bypass valve which is controlled by a fully computerised system.

The support member suitably comprises conductive material mounted in grooves on a metal platform. Part of 5 the conductive material is exposed above the surface of the platform for contact with the circuit board. The action of the cylinder means presses the conductive material onto the circuit board so that continuity testing of the circuit board can be achieved.

10 The apparatus provides for accurate testing of all compact and high density bareboards with SMT (Surface Mount Technology). The apparatus is particularly useful with Automatic Conductive Rubber Testing (ACRT) systems.

Advantages of the Invention:

- 15
1. Raises production throughput by reducing the number of testing cycles of present systems.
  2. Replacement of probes by conductive material that reduce the cost on probe and maintenance cost. This also 20 has an additional advantage since certain SMT pads' density is so high that even fine pitch probes are not applicable.
  3. Provides a smooth testing run by allowing a larger tolerance on pattern shift of the unit under test.
  4. Higher accuracy in testing high density SMT (Surface 25 Mount Technology) pad board.
  5. As conductive material does not occupy any pins resource, the number of testing pins of the system can be increased.

6. Maintenance processes for conductive material systems are reduced, so the cost and time in maintenance is reduced.

The invention will now be described by way of  
5 example with reference to the accompanying drawings in which:

Figure 1 is a side cross-sectional view of a testing apparatus in accordance with the invention, in its isolation test condition;  
10 Figure 2 is a side cross-sectional view of the apparatus in Figure 1, in its continuity test condition; and

Figure 3 is a schematic diagram of a bare board.

In Figures 1 and 2 a testing apparatus 10 is shown to give isolation and continuity tests on a printed circuit board 12.

In particular, the apparatus comprises an isolation test member in a form of a probe 14 which is movable up and down to contact certain points on the 20 printed circuit board (see Figure 1).

In Figure 2 the same apparatus is shown to undertake a continuity test on the printed circuit board.

In particular, the isolation probe together with a member 16 supporting a mask 18 made of conductive rubber, 25 which mask can bridge two points on the printed circuit board, act together to give the continuity test feature.

The apparatus includes a cylinder mechanism 20

for moving up and down the supporting member 16 towards and away from the printed circuit board.

The arrangement is controlled by a system controller, details of which follow:

5     SYSTEM CONTROLLER

The system controller unit recognizes if the user selects the testing function by checking a parameter "ACRT State" in a sub-menu "Product configure".

10       If the "ACRT State" is set to "On", the system controller will test and learn the PCB with the ACRT function.

Using ACRT, the PCB will be learned with two different processes. In particular, the data files of the 15 PCB with ACRT function include two different sets of data. Data (Data1) is first learned without contact between the conductive rubber 18 and the tested board 12, and data (Data2) is then learned with contact between the conductive rubber and the tested board.

20       In testing, the PCB will be tested with two different processes according the two different sets of data. First, the conductive rubber will contact with the tested board and start testing according to the information of Data2. Then, the conductive rubber will uncontact with 25 the tested board and start testing according to the information of Data1.

The system controller controls the state of the cylinder in the apparatus. If the conductive rubber 18 is needed to contact with the tested board 12, the controller will send a signal to make the cylinder move up, otherwise, 5 the controller will send another signal to make the cylinder move down.

The pneumatic cylinder 20, which is used to activate the action of the platform 16, is under the full control of a computer. This structure enables the testing 10 operation to be optimized in one cycle for multi-adaptation test.

Referring to Figure 3, part of the PCB 12 is shown under test. In particular, two adjacent SMT pads 22 and 24 on the PCB are shown with their corresponding ends 15 or branching ends being in contact by testing probes 26 and 28. Special conductive material 30 is employed to act as a "conductive bridge/short" between the two SMT pads 22 and 24.

The learning and testing mechanism consists of 20 two states. In the first stage, the conductive material 30 is in contact with every SMT pad (ie 22 and 24) so that a short path is provided between every SMT pad. The "OPEN/SHORT" reading at each testing probe is treated as the first set of data (ie Continuity Test). In the second 25 stage, the special conductive material 30 is isolated from every SMT pad (ie 22 and 24). Another "OPEN/SHORT" reading at every testing probe is treated as the second set of data

(ie Isolation Test).

The testing procedure will employ these two sets of data as reference to compare with the data generated by the unit under test in the two stages. However, all the 5 testing stages stated above do not require the removal of the unit under test or movement of the apparatus other than the cylinder. The mechanism provided completes the test in just one cycle.

OPERATION

10

1. To learn a test program with ACRT function:-

15

a. Select the correct parameters of "System configure" and "Product configure". In the sub-menu "Product configure", the "ACRT state" should be set to "On".

20

b. Select the sub-menu "Test/Learn".

c. Select the item "Start Learn".

d. Insert a "known good" PCB onto the apparatus.

25

e. Make the cylinder press the conductive rubber tightly with the PCB.

f. When the learning is finished, the machine will display number of short and number of open points of the PCB, and also if there exists check sum error.

5

g. Save the test pattern.

2. To test PCB with ACRT function:-

a. Load the data file of the tested board if it has 10 been saved on the disk. Otherwise learn the board before testing.

b. Select the correct parameters in "System Configure" and "Product Configure". Make sure 15 that the "ACRT state" in the sub-menu "Product configure" should be set to "On".

c. Select the sub-menu "Test/Learn".

20 d. Select the item "Start Test".

e. Insert a PCB onto the apparatus.

f. Make the cylinder press the conductive rubber 25 tightly with the PCB.

g. When the testing is ended, the cylinder will be

up and the machine will display if the board is passed or failed.

The advantages of the machine can be observed by the following points:-

- 5    1.       Fine pitch probes are saved, so the cost on test probes and its maintenance are reduced.
2.       Less difficult to construct the apparatus, especially relating to the control of tolerance, which implies cost reduction.
- 10    3.       As conductive material does not occupy any pins resource, so the number of testing pins of the system can be virtually increased.
4.       As ACRT accepts a large tolerance of pattern shift of unit under test, so the pressure of tight
- 15    5.       production control in tolerance can be released and the instance of wrongly rejected good board is greatly reduced.
5.       Ease of maintenance (just replace the conductive material) implies a smooth production run and less maintenance cost.
- 20    The ACRT is an excellent tool for testing of PCB with SMT (Surface Mount Technology), Chip on Board (COB), bonding in single-sided, double-sided and multi-layer board.

CLAIMS

1. Testing apparatus comprising means to effect an isolation test on a circuit board, said isolation test means being also used to effect a continuity test on the same circuit board in combination with other means.
2. Apparatus as claimed in Claim 1 wherein the isolation test means is a probe(s) to contact a certain point on the circuit board.
3. Apparatus as claimed in either Claim 1 or 2 wherein the means which in addition with the isolation test means effects the continuity test, is a member supporting at least one strip of conductive rubber which contacts together two points on the circuit board.
4. Apparatus as claimed in Claim 3 wherein the support member is moved towards and away from the circuit board by cylinder means.
5. Apparatus as claimed in Claim 4 wherein the cylinder means is a pneumatic cylinder which is actuated through a bypass valve which is controlled by a fully computerised system.
6. Apparatus as claimed in any one of Claims 3 to 5 wherein the support member suitably comprises conductive material mounted in grooves on a metal platform.
7. Apparatus as claimed in Claim 6 wherein part of the conductive material is exposed above the surface of the platform for contact with the circuit board being tested.

8.       Apparatus as claimed in either Claim 6 or 7  
wherein the cylinder means presses the conductive material  
onto the circuit board being tested.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

GB 9206068.0

**Relevant Technical fields**

(i) UK CI (Edition L ) G1U UR3128

Search Examiner

K F J NEAL

(ii) Int CI (Edition 5 ) G01R 31/28

**Databases (see over)**

(i) UK Patent Office

Date of Search

12 MAY 1993

(ii)

**Documents considered relevant following a search in respect of claims 1-8**

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2215064 A (GEC) - see abstract	1-3
X	GB 2156532 A (PLESSEY) - see abstract	1-3
X	EP 0250620 A1 (MANIA) - whole document	1, 2
X	WO 89/00296 A1 (CNRS) - see abstract	1-3
X	US 4571542 A (ARAI) - see abstract	1-3
X	US 4056773 A (SULLIVAN) - see abstract	1-3
X	US 4012693 A (SULLIVAN) - see abstract	1-3

Category	Identity of document and relevant passages	Relevant to claim(s)

#### Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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